

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, RADIATION COUNTER
TYPE 7840

This specification is approved for use by the Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

DESCRIPTION: Thin end mica window, self quenched counter tube for detection of low intensity beta radiation.

See figure 1.

Mounting position: Any.

Weight: 7 ounces (198.5 grams) nominal.

ABSOLUTE RATINGS:

Parameter:	Ebb	TA	Rp	Mica window thickness
Unit:	V dc	°C	Meg	mg/cm ²
Maximum:	1,600	40	---	2.2
Minimum:	1,300	0	1	1.8
Test conditions:	1,400	---	1	---

See footnotes at end of table I.

GENERAL:

Qualification - Required.

Holding period (MIL-STD-1311) - 60 days.

Window test - 13/

Shelf life - Required (see conformance inspection, part 1).

Acceptance test - Required. 16/

Service-life guarantee (MIL-PRF-1) - With qualifying activity approval manufacturer may provide service-life guarantee, in lieu of life test. Guaranteed tube operating time shall be 250 hours minimum. 23/

Marking - Tubes sold under service-life guarantee shall be marked with contract number and with the number of tube operating hours (250 hrs min) guaranteed. 23/

Comments, suggestions or questions on this document should be addressed to Defense Supply Center Columbus, ATTN: DSCC-VAT, P.O. Box 3990, Columbus, OH 43216-5000 or e-mailed to TubesFiberOptic@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil.

TABLE I. Testing and inspection.

Inspection	Method MIL-STD- 1311	Notes	Conditions	Symbol	Limits		Unit
					Min	Max	
<u>Conformance inspection, part 1</u>							
Background, contamination and photosensitivity	6201	<u>2/ 6/ 12/</u> <u>17/ 19/</u>	t = 4 minutes (min)	N/t	---	30	Npm
Starting voltage	6211	<u>5/ 12/ 17/</u> <u>20/ 21/</u>	Pulse amplitude = 0.50 V; Nps = 100 (min); R2 = 1 Meg \pm 10%; R1 = C1 = C2 = 0; C3 = 0.01 μ F \pm 10%	Es	---	1,250	V dc
End-of-plateau voltage	6216	---	Ps = 3%/100 V dc	Ee	1,650	---	V dc
Relative plateau slope	6216	<u>16/ 17/</u>	Voltage range = 1,300 to 1,600 V dc	Ps	---	3	%/100 V dc
Response count rate and current (beta)	6221	<u>3/ 6/ 12/</u> <u>17/</u>	Ebb = 1,400 V dc; counting time = 2 minutes (min)	N/t	<u>3/</u>	---	Npm
Shelf life	---	<u>15/</u>		---	---	---	---
<u>Conformance inspection, part 2</u>							
Leakage current	6205	---	Ebb = 700	Lib	---	0.5	μ A dc
Shock	1041	<u>1/ 11/</u> <u>22/</u>	450 G	---	---	---	---
Response count rate and current (hysteresis (1a))	6221	<u>6/ 7/ 8/</u>	Ebb = 1,400 V dc; t = 2 minutes (min); record count rate values	---	---	---	---
Response count rate and current (hysteresis (1b))	6221	<u>6/ 8/</u>	Ebb = 1,400 V dc; t = 15 minutes (min)	---	---	---	---
Response count rate and current (hysteresis (1c))	6221	<u>6/ 8/</u>	Ebb = 1,400 V dc; t = 2 minutes (min); from reading taken from count rate (1a)	N/t	---	\pm 20	%
Response count rate and current (gamma)	6221	<u>6/ 9/ 12/</u>	Ebb = 1,400 V dc; counting time = 2 minutes (min)	N/t	---	110	Npm

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method MIL-STD- 1311	Notes	Conditions	Symbol	Limits		Unit
					Min	Max	
<u>Conformance inspection, part 3</u>							
Life test	---	<u>23/</u>	Group D; Ebb = 1,400 V dc; N/t = 1,000 Npm; t = 250 hours	---	---	---	---
Life-test end points:	---	<u>23/</u>					
Response count rate and current (beta)	6221	---		N/t	---	±10	%
Response count rate and current (gamma)	6221	---		N/t	---	±10	%
Variable-frequency vibration	1031	<u>1/ 10/ 14/ 22/</u>	Ebb = 0	---	---	---	---
Temperature range, operating	1026	<u>4/ 14/</u>		N/t	---	±20	%
Packaging	---	<u>18/</u>		---	---	---	---

- 1/ Criterion for passing this test shall be compliance after test of at least 80 percent of the tubes with the requirements for the following:
- (a) Starting voltage.
 - (b) End-of-plateau voltage.
 - (c) Relative plateau slope.
 - (d) Response count rate and current (beta).
 - (e) Response count rate and current (gamma).
- 2/ The tube shall be exposed to radiation from a General Electric 4-watt germicidal lamp, Type G-4T4/1, or equivalent, with relative positions as shown on figure 2.
- 3/ The counting rate shall not vary by more than ± 0.10 N/t from the value (approximately 10,000 counts per minute (cpm)) marked on the Standard Beta Reference Source (SBRS). The SBRS shall be mounted in recess of the sample positioning shelf specified with the SBRS. The proper position of this shelf for this test is specified with the SBRS.
- 4/ With the tube in a field giving $10,000 \pm 100$ Npm at 1,400 V dc, tube response (count rate) shall be determined at 1,300, 1,400, and 1,600 V dc at each of the following temperatures and in the order shown.
- (a) Room temperature.
 - (b) 5°C.
 - (c) Room temperature.
 - (d) 40°C.
 - (e) Room temperature.

TABLE I. Testing and inspection - Continued.

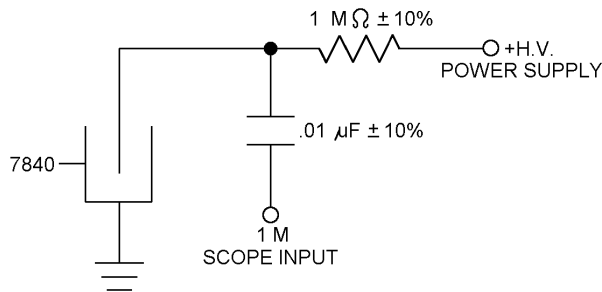
- 5/ After the holding period, starting voltage shall not vary by more than ± 7 volts.
- 6/ The tube shall be mounted vertically in the lead shield (see figure 3) of the excitation unit.
- 7/ The tube shall have been inoperative for a 24-hour period prior to test.
- 8/ Beta reference source shall be in position as specified in 3/.
- 9/ Test shall be performed with the assembly shown on figure 3 in a 1.4 mr/hr Cobalt-60 radiation field (calculated).
- 10/ The tube shall be tested only with its longitudinal axis vertical and parallel to the direction of motion. The tube shall be mounted by means of a rigid clamp at the base of the tube.
- 11/ The tube shall be tested only with its longitudinal axis horizontal and parallel to the direction of motion of the hammer. The tube shall be mounted by means of a rigid clamp at the base of the tube.
- 12/ This test shall be performed at the conclusion of the holding period.
- 13/ All tube windows shall be tested to assure that they can withstand an internal pressure of half of an atmosphere less than ambient pressure.
- 14/ This test shall be performed during the initial production and once each succeeding 12-calendar months in which there is production. A regular sampling plan shall be used, with sample of three tubes with an acceptance number of zero. In the event of failure, the test will be made as a part of conformance inspection, part 2, with an acceptance level of 6.5. The regular "12-calendar month" sampling plan shall be reinstated after three consecutive samples have been accepted. This specification sheet uses accept on zero defect sampling in accordance with MIL-PRF-1, table III.
- 15/ The shelf life requirements shall be as follows:
 - (a) Tubes tested and acquired in accordance with this document shall be capable of a shelf life for a period of 18 months after the date of shipment from the manufacturer's plant. At anytime during this shelf life period the tubes shall be capable of meeting all requirements of conformance inspection, part 1, as specified herein. Tubes found to be defective within the shelf life period shall be replaced by the manufacturer at no cost to the Government.
 - (b) A shelf life of 90 days with the conformance inspection, part 1, starting voltage test shall be instituted during continuous production, but shipments of that month's production shall not be held pending completion of the test. Tubes shall be considered to conform to this document when three of the four tubes for each of the first 3 month's production and 75 percent of the cumulative quantity pass the test. If either of the above conditions are not satisfied, shipments shall be halted until three or four tubes of current production conform to the starting voltage test.
- 16/ The relative plateau slope requirements shall be with the discrimination level of the scaler set at $0.25 \text{ V} \pm 10$ percent for standard Geiger-Mueller counter tube operation, and accomplished in accordance with the following steps:
 - (a) With the equipment in operation and prepared for counting, set the high voltage adjust control to obtain 1,400 V dc.
 - (b) Mount standard reference source SBRS on the sample positioning shelf, place the shelf in position 1 of the tube, mount assembly and count for 5 minutes at 1,400 V dc. A new Geiger-Mueller counter tube (one that has not been used for a month or more) should be counted for 15 minutes rather than 5 minutes. It is not necessary to record the count rate obtained in this step.
 - (c) If the background is unknown, remove SBRS and obtain and record a 20 minute background count rate (cpm).
 - (d) Place SBRS on the sample positioning shelf; place shelf in position 1 of the tube mount assembly.

CAUTION

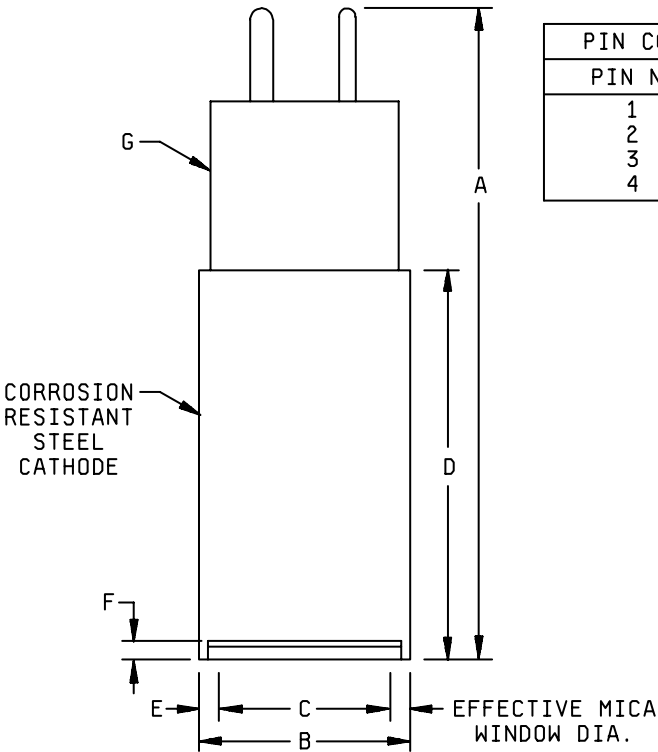
If at any time while performing steps 16e through 16g it becomes apparent that the tube under test is in continuous discharge (rapidly increasing count rate for a constant value of applied voltage), immediately set high voltage adjust control to 1,200 V dc. Determine if tube damage has occurred by raising the voltage in 50 V dc increments every 5 minutes. Do not exceed a high voltage setting of 1,500 V dc at any time. Otherwise continuous discharge will damage the tube. If continuous discharge occurs, again, replace tube.

TABLE I. Testing and inspection - Continued.

- (e) Count SBRS for 100,000 counts minimum in the same position at 1,300 V dc and determine and record count rate in counts per minute (cpm). Count rate N1 equals total count divided by counting time in minutes minus background.
 - (f) Count SBRS for 33,333 counts minimum in the same position at 1,400 V dc and determine and record count rate in counts per minute. Count rate N2 equals total count divided by counting time in minutes minus background.
 - (g) Count SBRS for 100,000 counts minimum in the same position at 1,500 V dc and determine and record count rate in counts per minute. Count rate N3 equals total count divided by counting time in minutes minus background.
 - (h) Determine plateau slope in percent as follows: Percent per 100 V dc slope equals 100 times (N3 minus N1) divided by the quantity (N3 plus N1). This result shall be less than or equal to ± 3 percent per 100 V dc.
 - (i) The measured count rate N2 shall be within ± 10 percent of the quantity, (N1 plus N3) divided by 2.
- 17/ Sampling shall comply with zero defect sampling in accordance with MIL-PRF-1, table III, with an acceptance level of 6.5, and be witnessed by DCAS/DCASR.
- 18/ Each tube shall be packaged in a container capable of withstanding pressures in the range of 87.3 to .760 mmHg.
- 19/ Spurious pulses of amplitude greater than four volts shall not occur after four minutes of operation.
- 20/ A new Geiger-Mueller tube (one that has not been used for a month or more) should be counted at 1,400 V with standard reference source SBRS on shelf in position 1 of the tube-mount assembly for 15 minutes before starting voltage is measured.
- 21/ Starting voltage test circuit:



- 22/ The manufacturer, with the approval of the qualifying activity, may perform this test on a periodic basis, versus performing the test on every lot. Approval will be based on demonstrating to the qualifying activity the capability of the design to meet this requirement. If the design, material construction or processing of the tube is changed or if there are any quality problems, the qualifying activity may require resumption of the original testing frequency. This allowance does not relieve the manufacturer from meeting the test requirements in case of dispute.
- 23/ With qualifying activity approval the manufacturer may provide, in accordance with MIL-PRF-1, service-life guarantee, in lieu of performing life testing. Life test endpoints specified shall apply to service-life guarantee conformance as well as to life test conformance. The number of hours of system-deployed, accumulated tube-operating time shall be approved by the qualifying activity and shall be a minimum of 500 hours. Service-life guarantee shall define tube operating life and not time from purchase or delivery. Tubes sold under service-life guarantee shall be marked with contract number and with the number of tube operating hours guaranteed.



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 2				
A	---	4.50	---	114.3
B	1.367	1.385	34.72	35.18
D	2.610	2.640	66.29	67.06
Conformance inspection, part 3 (see note)				
G	Base: A4-9 (EIA)			
Reference dimensions				
C	1.125		28.58	
E	.109		2.77	
F	.031		0.79	

NOTE: Dimensions shall be checked during the initial production and once each succeeding 12-calendar months in which there is production. A sampling plan shall be used, with sample of three tubes with acceptance number of zero. In the event of failure, the test will be made as a part of conformance inspection, part 2, acceptance level 6.5. The regular "12-calendar month sampling plan may be reinstated after three consecutive samples have been accepted. This specification sheet uses accept on zero defect sampling in accordance with MIL-PRF-1, table III.

FIGURE 1. Outline drawing of electron tube types 7840.

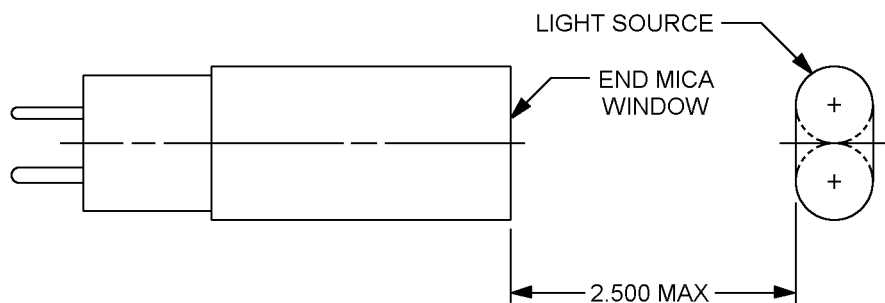


FIGURE 2. Position of tube for photosensitivity test

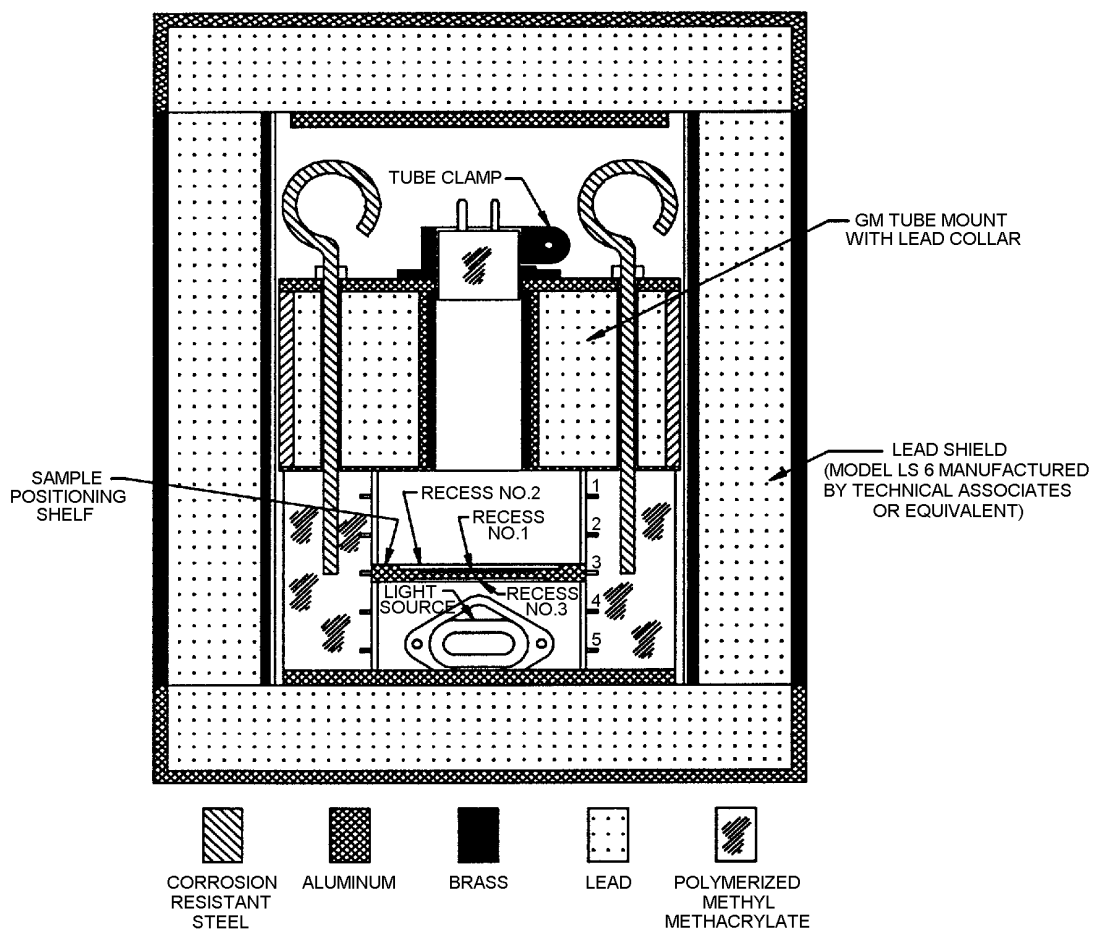


FIGURE 3. Tube position and shielding for response tests.

NOTES

Referenced documents. In addition to MIL-PRF-1, this specification sheet references MIL-STD-1311.

Custodian:
Navy - EC
DLA - CC

Preparing activity:
DLA - CC

(Project 5960-3708)

Review activities:
Navy - AS, MC, OS

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at www.dodssp.daps.mil.

Changes from previous issue. The margins of this specification sheet are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.